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Examinations of Alameda County Vineyard Soils.

Soils from Livermore Valley.—In order that the position of the following soils may be understood, the general features of Livermore valley must be defined to some extent, the more as this valley is fast coming into prominence as a viticultural district as well as for its cereal crops.

Livermore valley is about 14 miles long, east and west, from five to eight miles wide, and is surrounded by rolling foothills and mountains, from which other small valleys open into it. The northern and eastern part of its surface is a plain, the southern and western part a region of rolling hills, and all is dotted over with oak trees, and watered by numerous streams, timbered with sycamore, and tributary to Alameda creek, which flows westward into the bay of San Francisco through a canyon in the Coast Range. The soil of the eastern valley plain is dun-colored, with a pale yellow loam sub-soil; often gravelly, more especially near the watercourses, the beds of which in summer appear filled with gravel only, although water is mostly found beneath. Of the soil of the plain no samples have yet as been received. The soil of the rolling uplands lying southward of Pleasanton is mainly a red, often quite stiff, clayey and more or less gravelly loam, which also forms the subsoil where (as is the case very frequently) the surface soil is dark-tinted. These alternations occur from one hill to another, the dark soil lying chiefly on the lower ones. The rolling region is traversed, or in part skirted on the west, by the "Arroyo del Valle," a creek heading in the coast range near Mt. Hamilton. Within the range it carries running water throughout the year, but after emerging from the canyon its gravelly bed hides the water during most of the summer. Its valley, usually about ¼ mile or more in width, is beautifully dotted with large oaks; its soil very gravelly, and mostly dark-colored and very deep, although there are tracts where it is whitish and shallow with pure gravel beneath. Along the sides of the valley there is usually more or less of terrace or bench lands, having a sandy loam soil free from gravel, and changing but little for 5 to 8 feet.

It is in the rolling lands, in which the coast winds are much less felt than in the open valley on the east, that the planting of grape vines has chiefly been undertaken, and so far with very flattering results. In the table below, Nos. 692, 693, and 694 represent the two chief varieties of the *rolling lands*, the samples having been taken by Col. Geo. E. Edwards of the University, and analyzed for him by Mr. Geo. E. Colby; the results are given here by his courtesy. The land from which they are taken lies about a mile west of Livermore town, and is fairly representative of the best class of upland in the region.

No. 649 is from the lower portion of the tract owned by Mr. Chas. A. Wetmore, at the *Ojo del Monte*, a basin-like expansion of the canyon just prior to its emergence into the open lands, and well protected from cold winds on all sides. The alluvial terrace from which the sample was taken was covered with a heavy growth of brush and tall weeds, with some large sycamores. It is a whitish silt with some tangible sand intermixed, easy of tillage and of very uniform character for several feet; sample taken to the depth of twelve inches.

Nos. 749 and 752—bench land soil and under-subsoil, from the eastern portion of "Olivina Vineyard," the property of Mr. J. P. Smith. This tract is situated a short distance below the "Ojo del Monte," just referred to, and its lower portion appears to have substantially the same soil as No. 649, with the admixture of some gravel. Here the vines flourish admirably; but they do not do as well on the bench land, which forms a narrow terrace at the base of the hills. Hence the request for the analysis, in order, if possible, to determine the cause and possible remedy or this trouble. The soil is a sandy loam of dun of grayish tint, and scarcely changes for from four to five feet. The sample No. 749 was taken to 13 inches depth, the under-subsoil at the depth of three feet. Both alike contain about 19 per cent of sand too coarse to pass through a 1-50 inch sieve-mesh; the analysis represents the composition of the "fine earth" passing the sieve.

LANDS OF LIVERMORE VALLEY, ALAMEDA COUNTY.

	Rolling Uplands.			Valley. (Ojo del Monte)	Bench Land.	
	Dark Soil.	Subsoil.	Red Gravelly Soil.	Sediment Soil.	Soil.	Under-Subsoil.
	No. 692.	No. 693.	No. 694.	No. 649.	No. 749.	No. 752
Insoluble matter	80.262 } 85.285	80.658 } 85.815	81.941 } 85.697	71.156 } 76.094	78.693 } 86.611	77.645 } 86.019
Soluble silica	5.023	5.157	3.756	4.938	7.918	8.374
Potash	0.299	0.357	0.323	1.143	0.378	0.495
Soda	0.108	0.121	0.081	0.123	0.233	0.209
Lime	0.813	0.693	0.720	2.049	0.511	0.728
Magnesia	0.647	0.668	0.563	3.046	0.561	0.634
Br. oxide of manganese	0.065	0.025	0.030	0.044	0.105	0.056
Peroxide of iron	3.584	3.647	3.620	5.648	2.091	2.218
Alumina	4.933	5.329	5.545	7.153	5.966	6.764
Phosphoric acid	0.066	0.062	0.061	0.117	0.049	0.031
Sulphuric acid	0.010	0.008	0.008	0.101	0.076	0.085
Carbonic acid	......	......	......	1.004	......	......
Water and organic matter	4.047	3.435	3.550	3.679	3.140	2.532
Total	99.857	100.158	100.193	100.201	99.821	99.821
Humus	......	......	......	0.398	0.705	......
Available inorganic	......	......	......	0.413	0.606	......
Hygroscop. moisture	5.670	6.120	4.530	5.668	2.570	3.387
Absorbed at	15.C°	15.C°	15 C°	15.C°	6.5C°	9.5C°

The most striking point in this table is the wide difference between the uplands and the valley soil from the Ojo del Monte. The latter has an extraordinarily high percentage of potash, a very large one of lime, and a fair one of phosphoric acid, but is very poor in humus. In the upland soils, which differ very little from each other in composition, the supply of potash is less than one third as high as in the valley, that of lime somewhat over one third; while the phosphoric acid is only about one half as high, and but just above the usual limit of deficiency. The limit is passed in the case of the bench soil, in which the supply of phosphates is quite deficient. Hence the difference between the thriftiness of the vines on the bench and in the valley is sufficiently accounted for, and the remedy is the use of bone meal.

As regards the uplands, the relatively considerable supply of lime will probably maintain the needful supply of available phosphoric acid for some years; but with them also the use of bone meal or other phosphate fertilizers will be among the first things called for when the vines have borne for some years. Great care should be taken to return the pomace and distillery wash to these soils, so as to exhaust as little as possible their supply of phosphates and potash, although the supply of the latter is above the point of deficiency, in the bench land quite ample.

Altogether it appears that these upland lands are of the kind usually designated as being most profitable in vineyards or fruit culture, as grain would exhaust them very rapidly; and on the same grounds, they would naturally be expected to be prominent for quality rather than quantity unless fertilized; while the reverse would be expected of the valley.

Slate-colored upland adobe soil, from the rolling upland, a mile west of Mission San Jose, south of Washington Corners road; E. W. Hilgard's land.* This sample is representative of the heavier soil of the ridges in this neighborhood, now mostly occupied by vineyards; also of the higher (southern) portion of Mr. Gallegos' vineyard. The lower portion of the latter has a lighter soil, an intermixture of the adobe with the alluvial silt of Mission creek; while in the smaller valleys to southward there is a deep black, calcareous soil, much lighter in tillage than the upland adobe. The southward slope from the ridge occupied by the latter soil also has a lighter soil, resulting from the admixture of the sandy materials which underlie the whole of the Mission promontory, down to the railroad track. Wherever the latter are near the surface, the soil is quite light, even on the ridges, as in most of the broken lands. Where the adobe prevails, however, there often lies just above the pervious sandy strata, at depths varying from $1\frac{1}{2}$ to 4 feet, a "cement" layer, i. e., an intimate mixture of sandstone fragments with a heavy, yellow clay, which is at times quite impervious both to water and to roots, and causes some difficulty in the drainage, and therefore in the working of the adobe soil. The latter when packed by heavy rains, or tillage when too wet, is very close and adhesive, and dries into lumps of stony hardness. These, however, crumble quickly when again wetted, and when once in good tilth the soil retains it remarkably well; locally, it contains some small grains, but mostly it is without coarse materials, and all of it will pass through a sieve with meshes of 1-50 inch. The mechanical analysis gave the following result:

No. 789—Upland Adobe, Mission San Jose.

Clay	34.158
Sediment of <0.25 mm. hydraulic value	18.240
" " 0.25 mm	1.612
" " 0.5 mm	2.607
" " 1.0 mm	1.539
" " 2 0 mm	3.570
" " 4 0 mm	4.115
" " 8.0 mm	7.162
" " 16.0 mm	11.924
" " 32 0 mm	7.314
" " 64.0 mm	2.515
Total	94.756

According to the percentage of clay in this soil, it should not be materially heavier in work-

*Analysis by Mr. Geo. E. Colby, of the Agricultural Class of 1882, working as a volunteer at the time.

ing than is that of the agricultural grounds at Berkeley. But a comparison of the two shows that in the Berkeley soil the finer sediments exist in considerably larger proportion than in that from the Mission, which explains the greater tendency of the latter to "run together" under the influence of heavy rains.

The chemical analysis of the soil resulted as follows:

No. 789—Chemical Analysis.

Insoluble Matter	64.790	81.354
Soluble Silica	16.564	
Potash	.579	
Soda	.100	
Lime	.863	
Magnesia	.978	
Br. Oxide of Manganese	.022	
Peroxide of Iron	3.791	
Alumina	7.718	
Phosphoric Acid	.143	
Sulphuric Acid	.006	
Water and Organic Matter	4.601	
Total	100.160	
Humus	.697	
Available Inorganic	.596	
Available Phosphoric Acid	.028	
Hygroscop Moisture	9.74	
Absorbed at	11° C	

This analysis shows the supplies of potash and phosphoric acid to be ample, the latter being more than twice as high as the average of the lighter soils of the Coast Range opposite, or of the Livermore valley, as given above. But for so heavy a soil the supply of lime is not as high as would be desirable for easy tillage or even thriftiness to the full extent of which the soil is capable; nor is the supply of humus nearly as large as it should be. In both respects, therefore, the soil is capable of improvement, by liming and green manuring. The partial examination of the deep black adobe of the valleys, for comparison in the latter two points, gave the following result:

	PER CENT.
Lime	2.91
Humus	3.08
Available inorganic	1.03
Available phosphoric acid	.054

These data convey some idea of the effect of the addition of lime and vegetable matter to the gray adobe of the ridge. The amount of available phosphoric acid is more than doubled, and the surprising growth made by young seedling vines in this soil, as compared with the ridge soil, speaks of the difference in favor of the former.